

Investing in the Ultimate Green Product: Efficiency

NREL Growth Forum

November 7, 2005

SFO

Arthur H. Rosenfeld, Commissioner

California Energy Commission

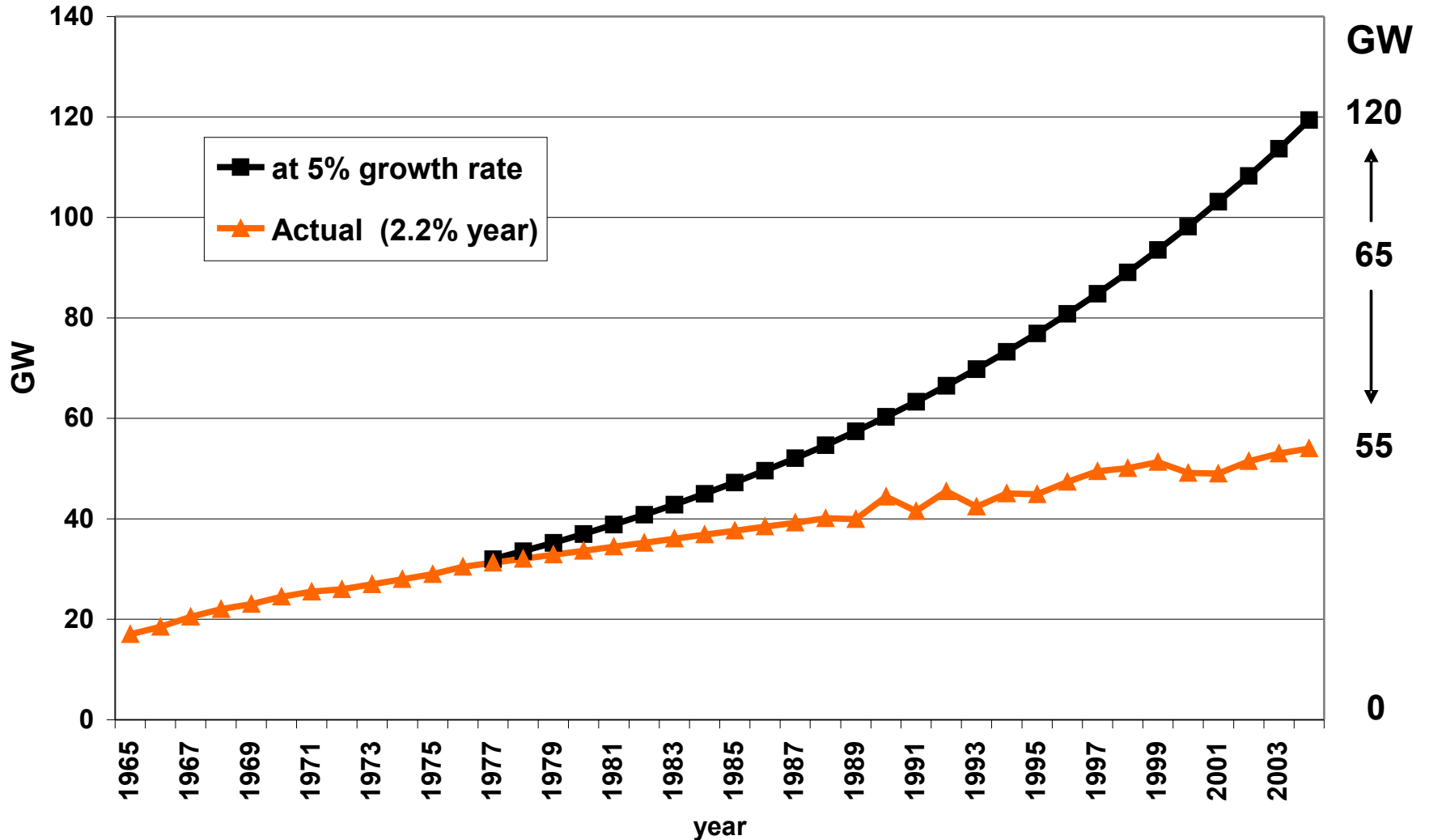
(916) 654-4930

ARosenfe@Energy.State.CA.US

For my Autobiography, visit

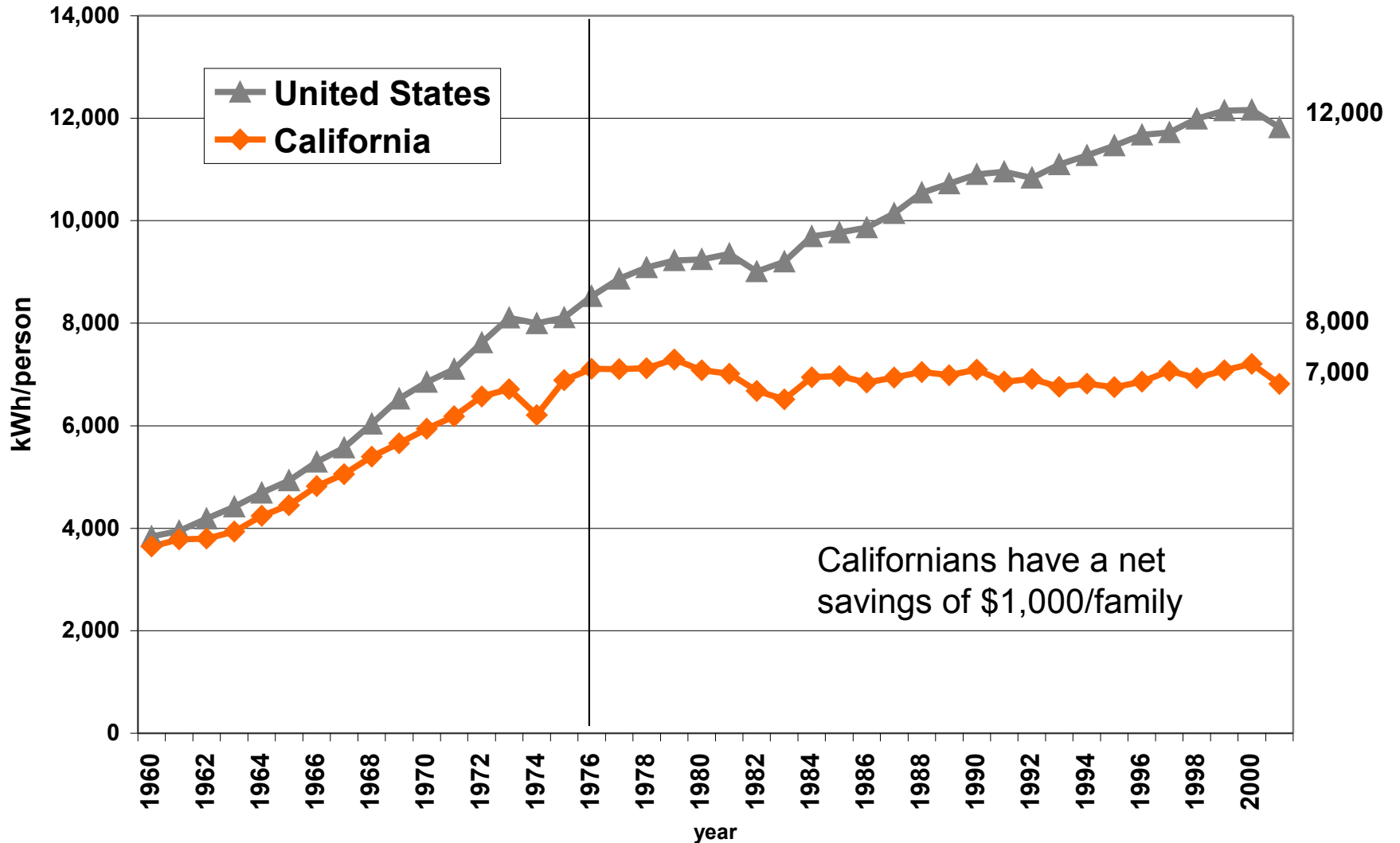
<http://www.energy.ca.gov/commission/commissioners/rosenfeld.html>

California Peak Demand 1965 - 2004



Per Capita Electricity Consumption

Source: http://www.eia.doe.gov/emeu/states/sep_use/total/csv/use_csv

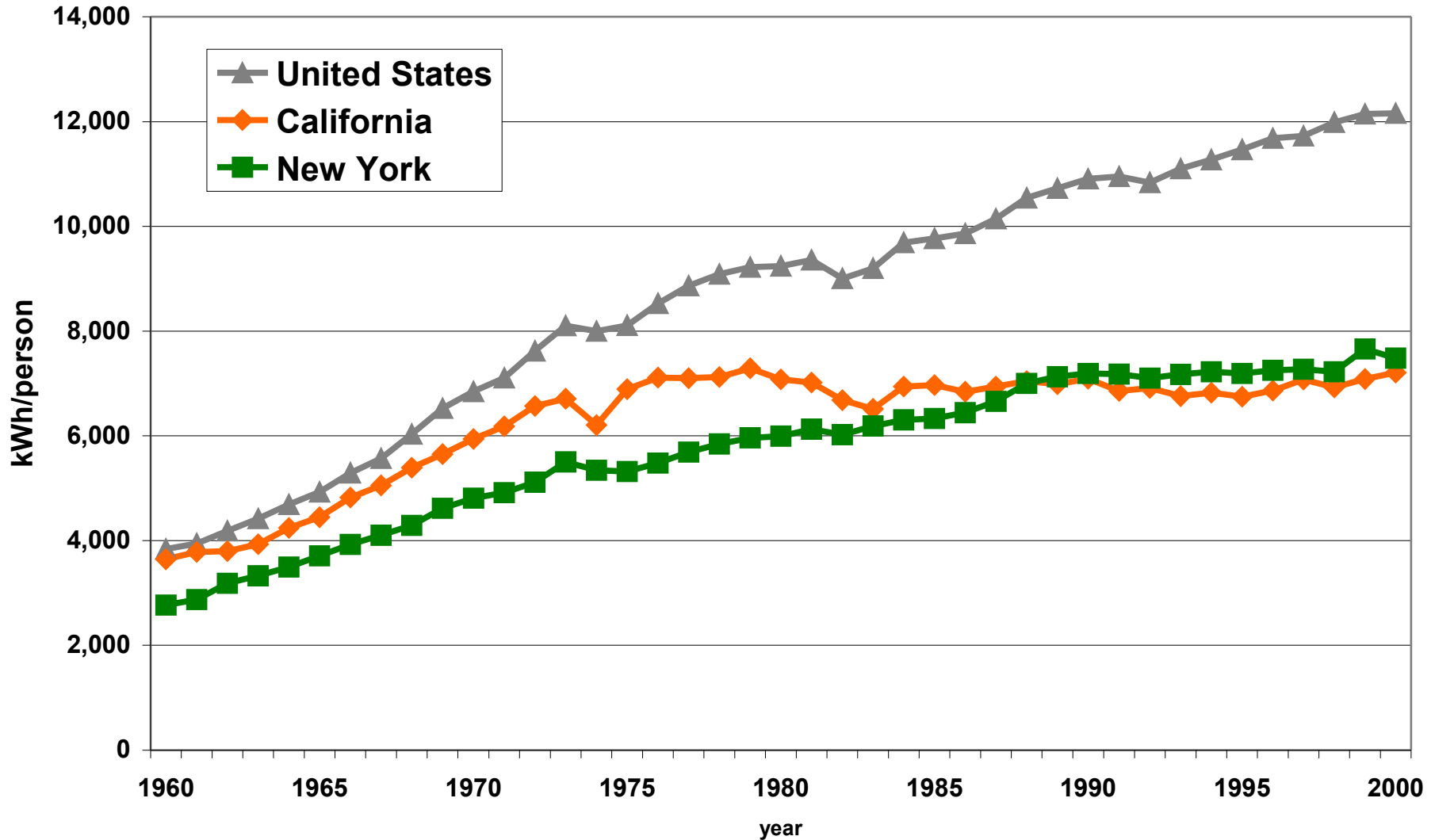


Costs and Pollution Saved by Avoiding a 50% expansion of California Electric System.

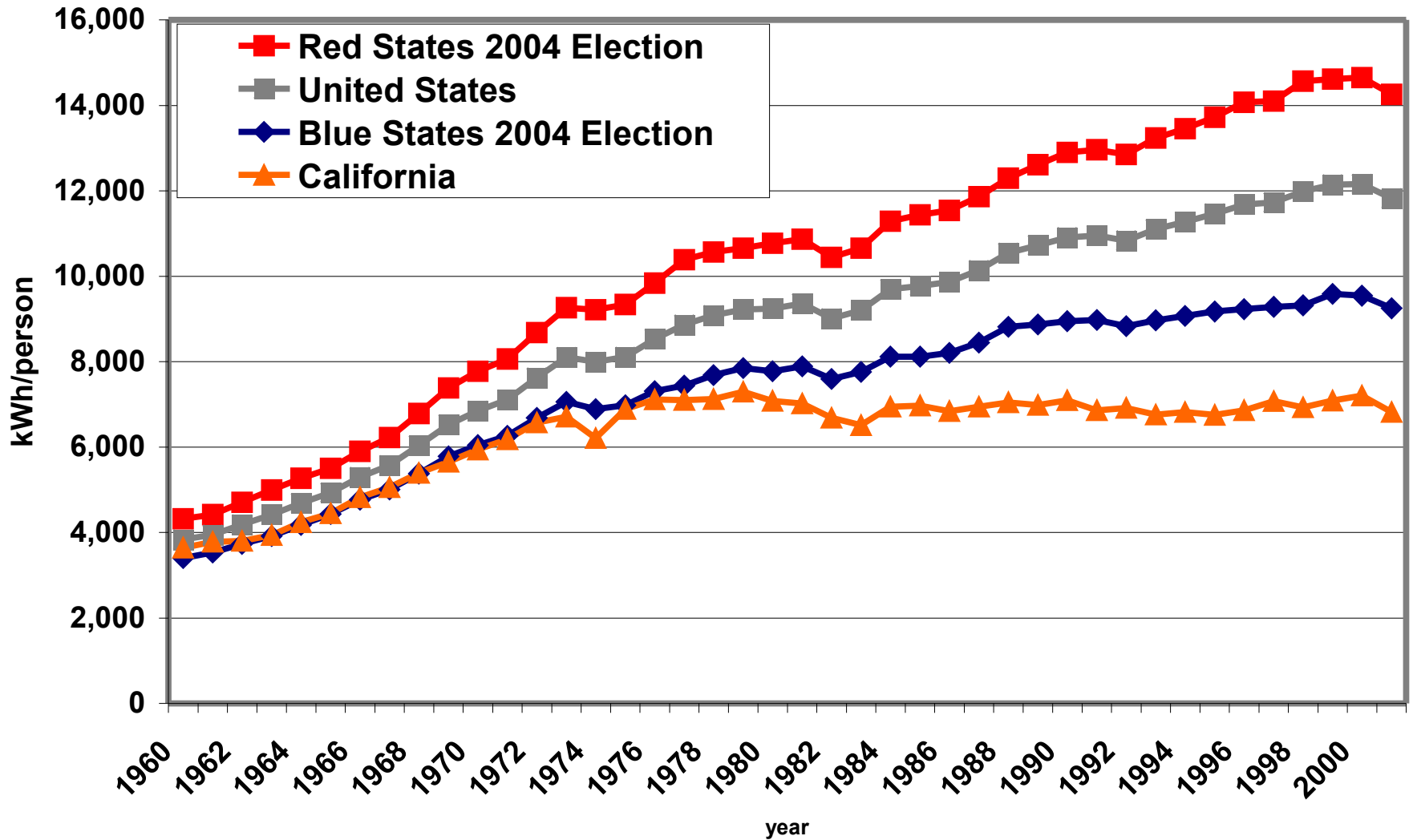
- ◆ Avoids 18 Million tons/year of Carbon
 - ◆ Equivalent to getting 12 million cars off the road,
 - along with their NOx, CO, and particulate emissions.
 - ◆ California has ~25 million motor vehicles,
 - avoided 50% more equivalent pollution.
 - ◆ The Pavley bill, starting in model year '09, should start to reduce another 30%.
-
- ◆ California annual electric bill in 2004 ~ \$32 Billion
 - ◆ Avoided ~\$16 Billion of bills, but net saving is only ~\$12Billion/year, i.e. **\$1000/family.**

Per Capita Electricity Consumption

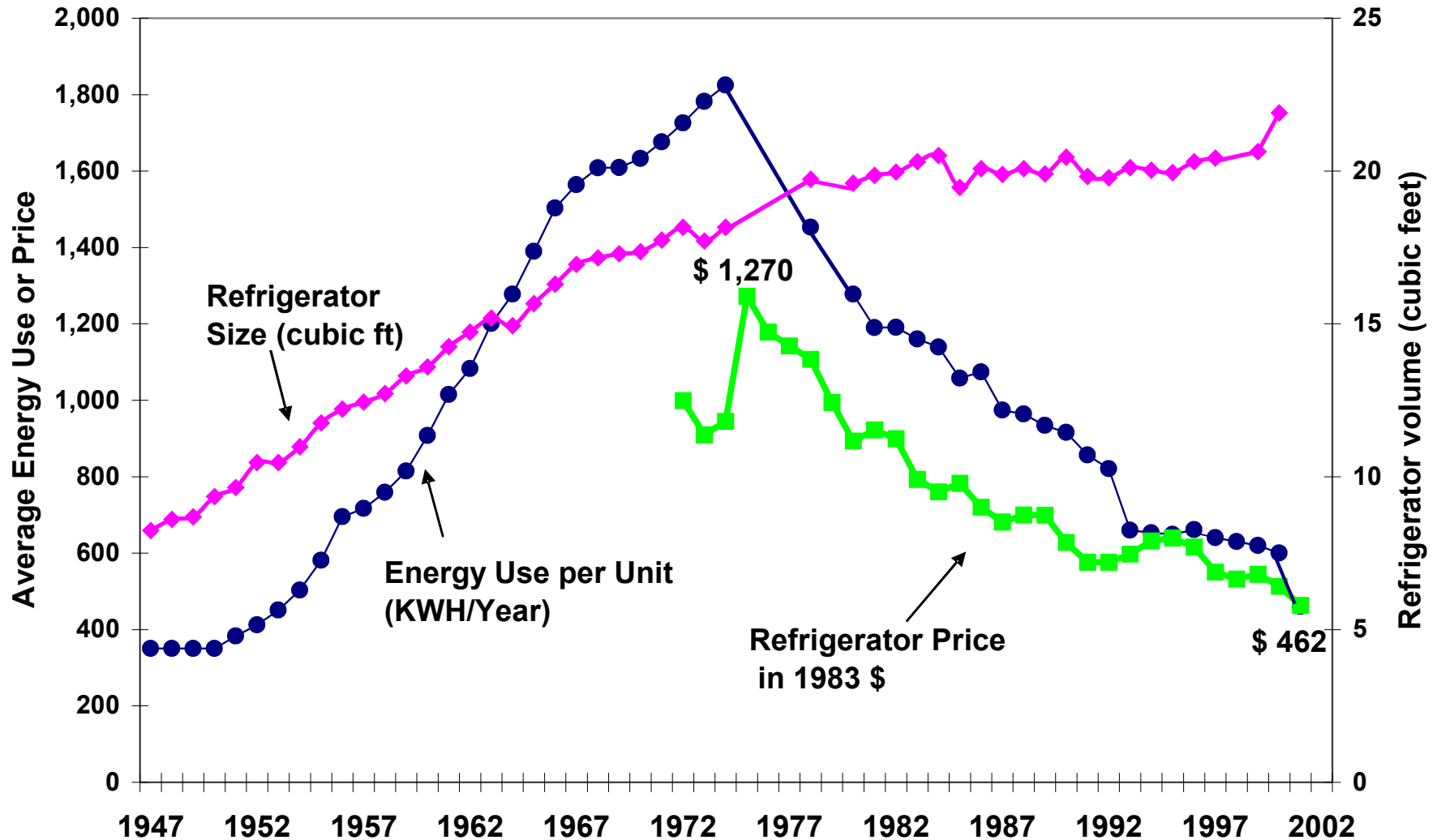
Source: http://www.eia.doe.gov/emeu/states/sep_use/total/csv/use_csv



Per Capita Electricity Consumption



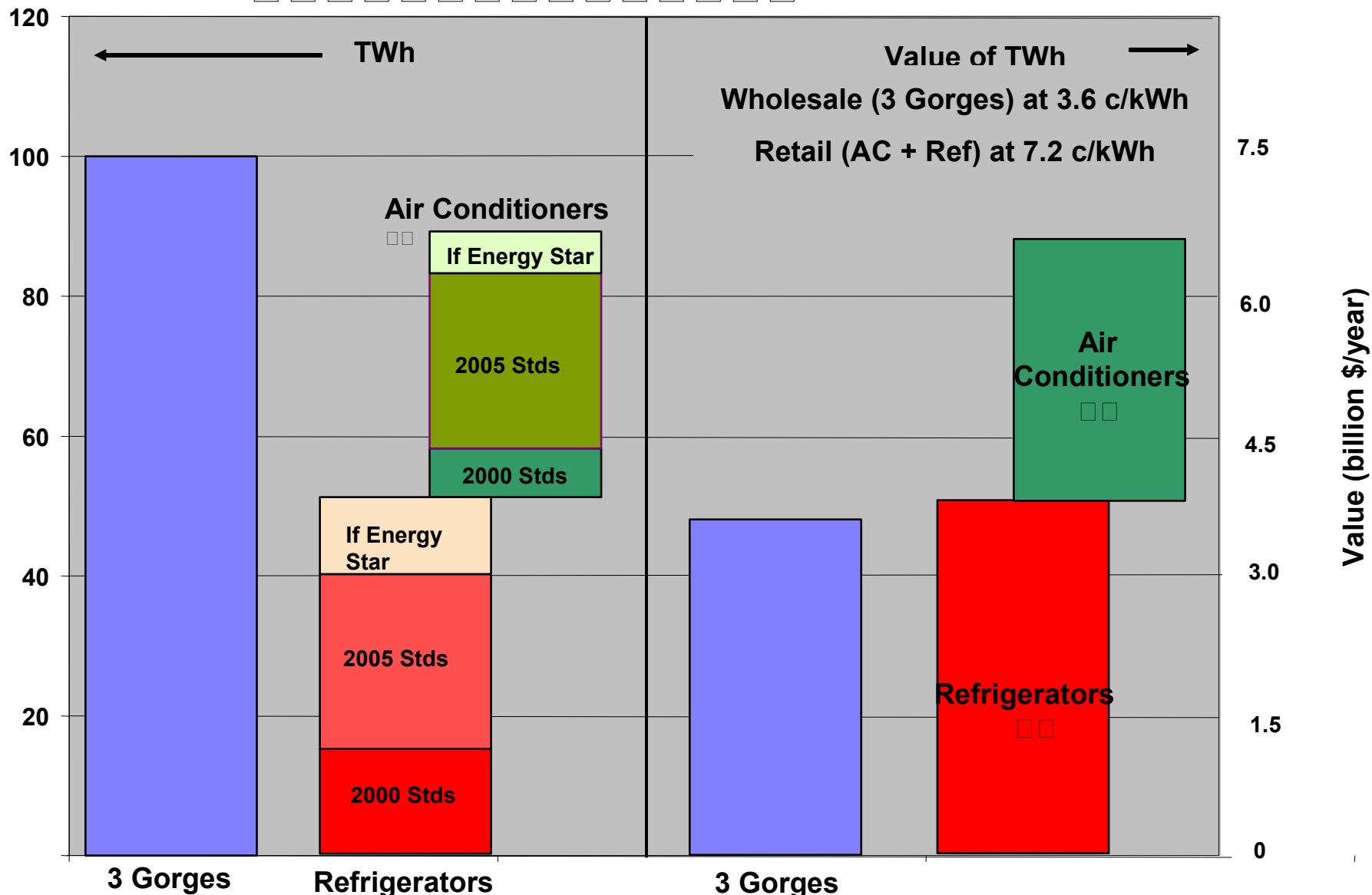
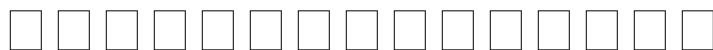
United States Refrigerator Use v. Time



Source: David Goldstein

Arthur Rosenfeld, 7

Comparison of 3 Gorges to Refrigerator and AC Efficiency Improvements



□ □

□ □

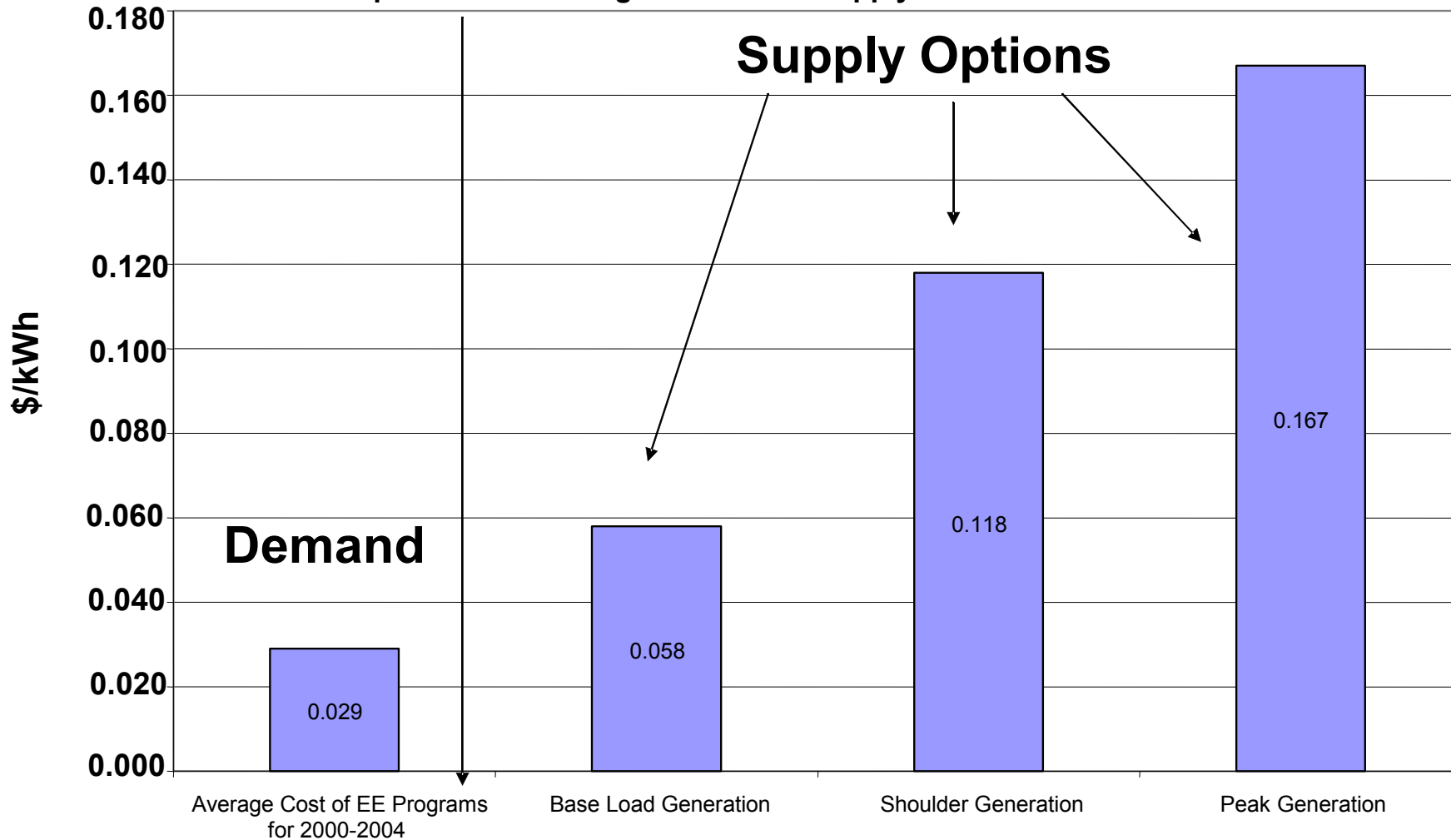
□ □

□ □ □ □ □ □ 10 □ □ □ □ □ □

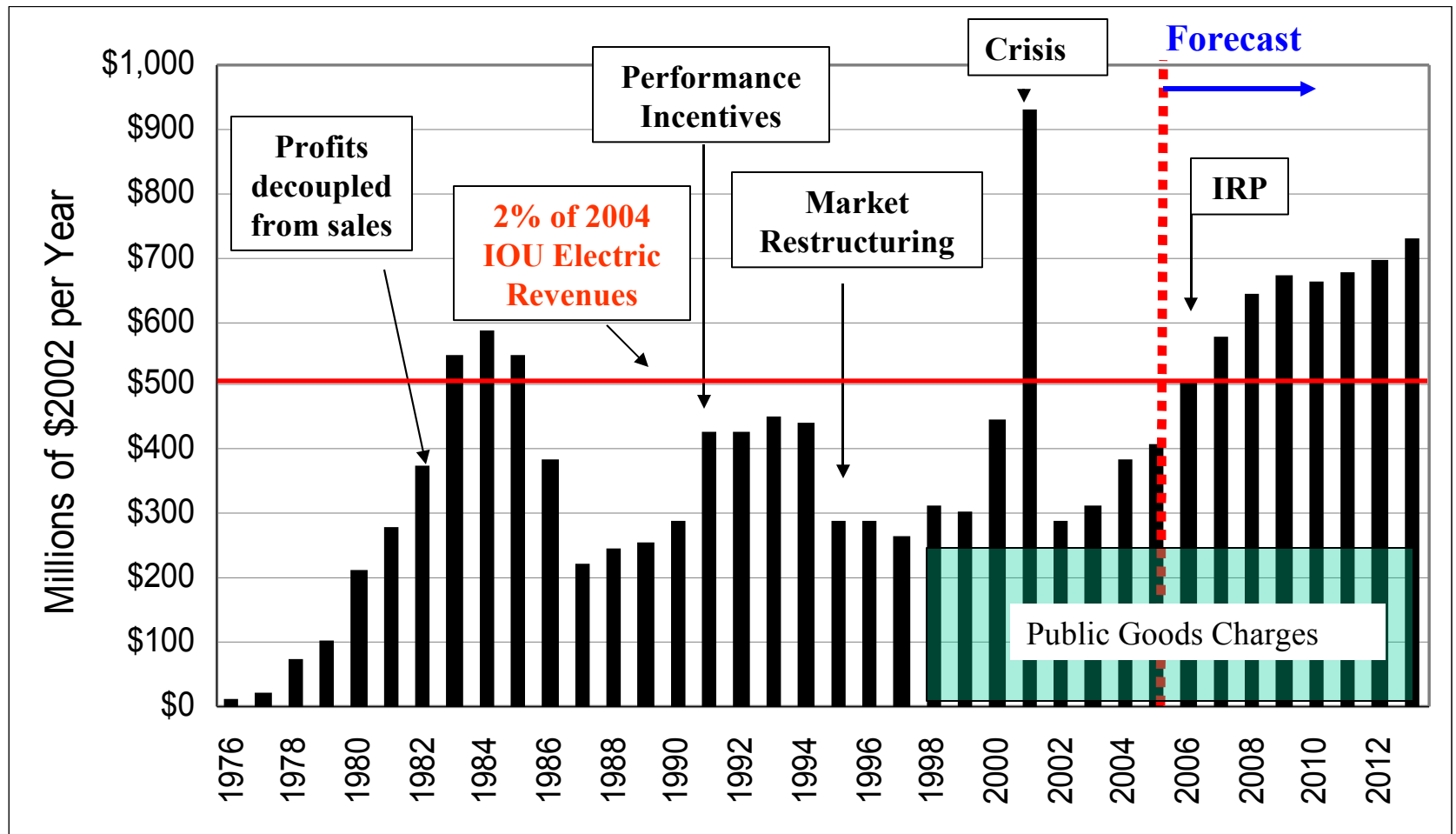
Savings calculated 10 years after standard takes effect. Calculations provided by David Fridley, LBNL

Arthur Rosenfeld, 8

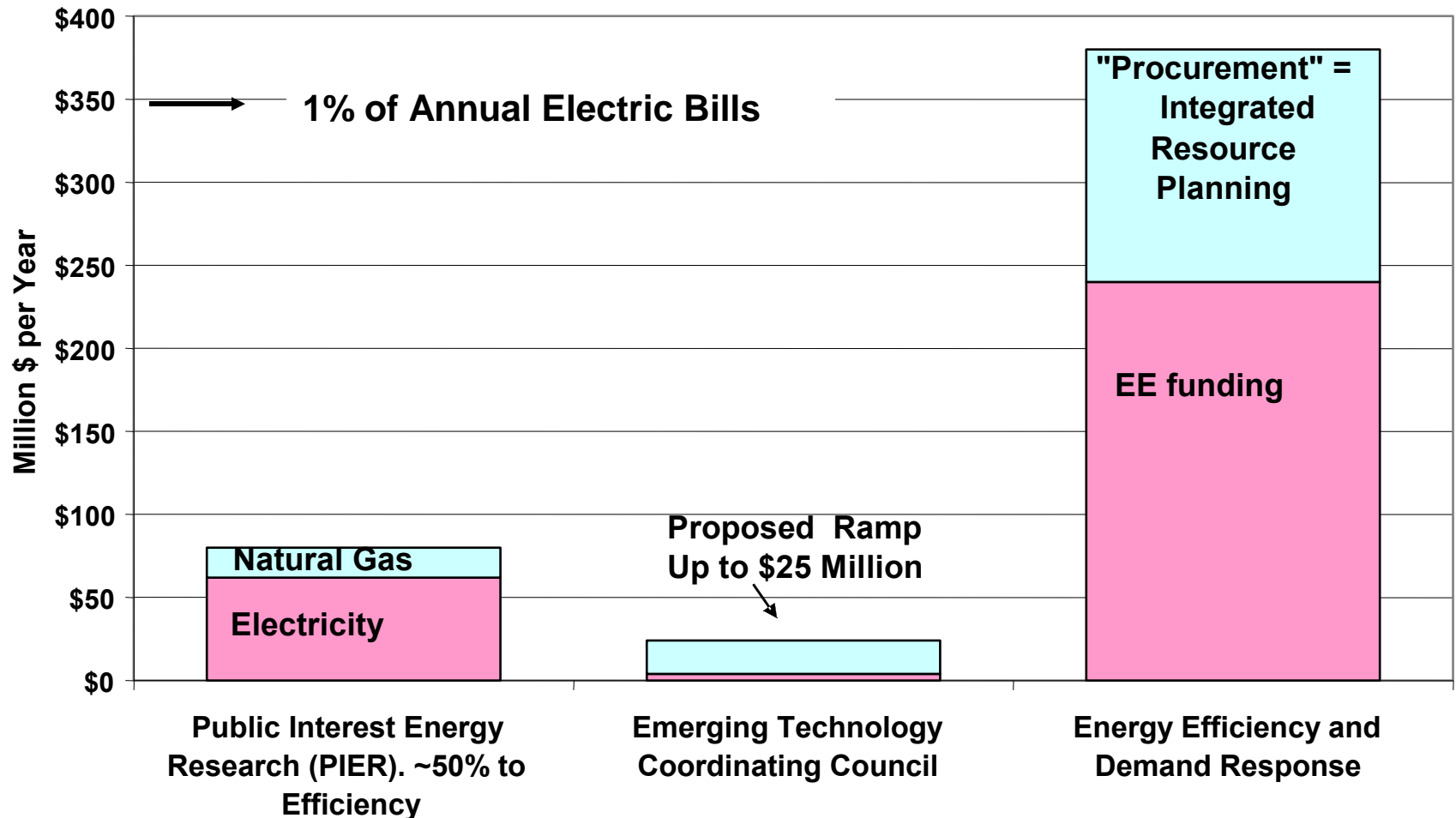
Figure 8
Comparison of EE Program Costs to Supply Generation Costs



California IOU's Investment in Energy Efficiency



Public Goods and Procurement Funding for Efficiency



The California Clean Energy Fund (CalCEF)

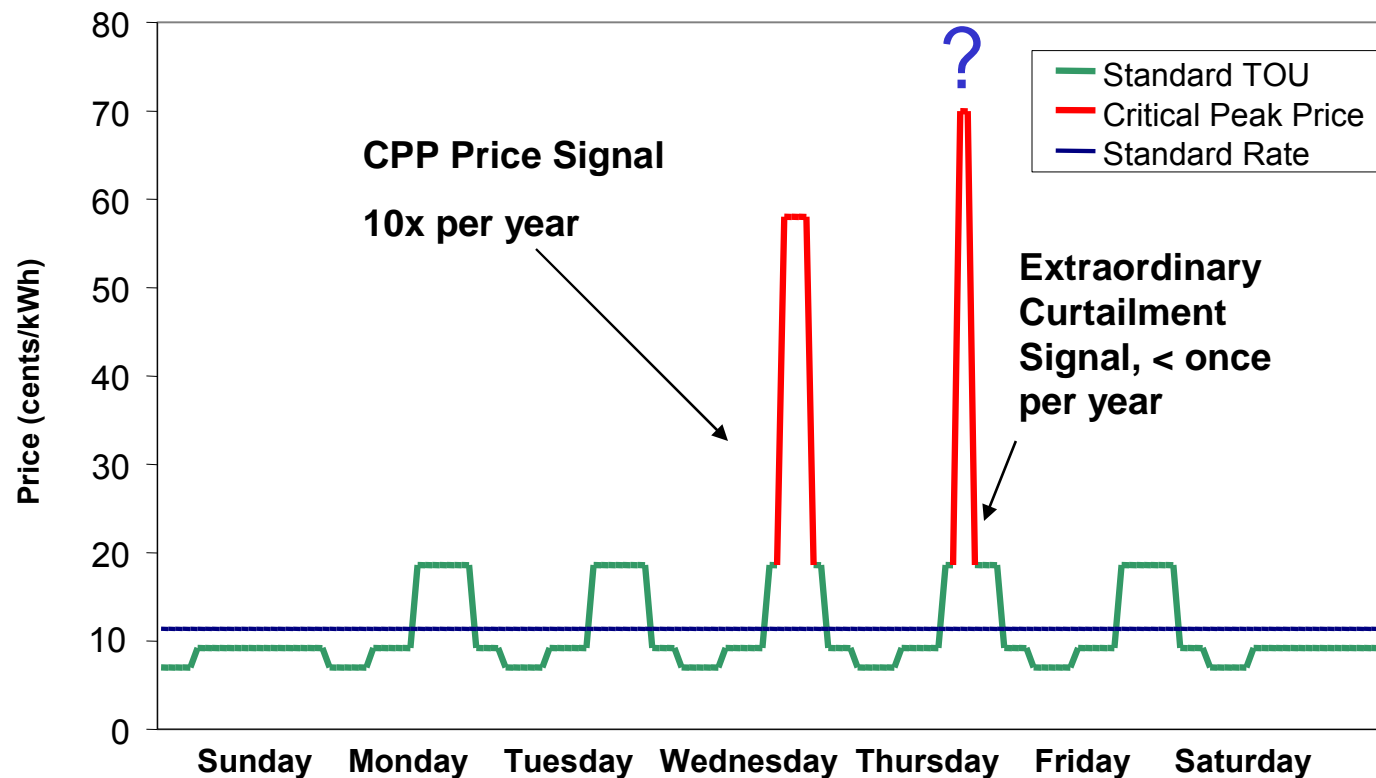
A new \$30 million fund formed to make equity investments in clean energy technology companies in California

- Non-profit, public benefit, evergreen fund
- Established as a result of the Settlement Agreement between PG&E and the California Public Utilities Commission
- Mission is create an investment vehicle that serves as a catalyst to advance California's clean energy agenda
- Board of Directors blends public policy makers, investment professionals, and science and technology experts

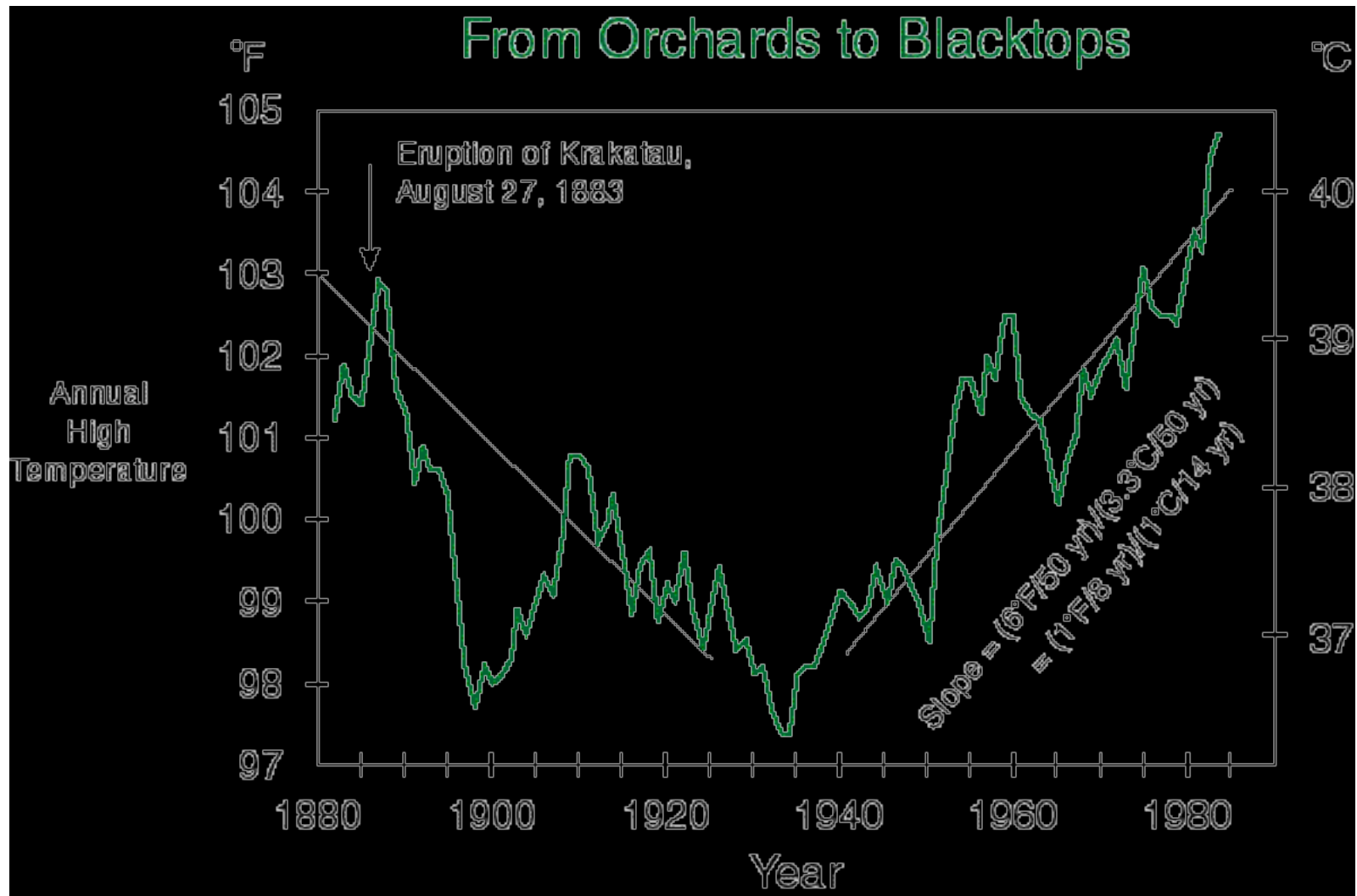
Critical Peak Pricing (CPP) with additional curtailment option

Potential Annual Savings per House with AC:

10 afternoons x 4 hours x 1kw = 40 kWh at 70 cents/kWh = ~\$30/year



Temperature Trends in Downtown Los Angeles

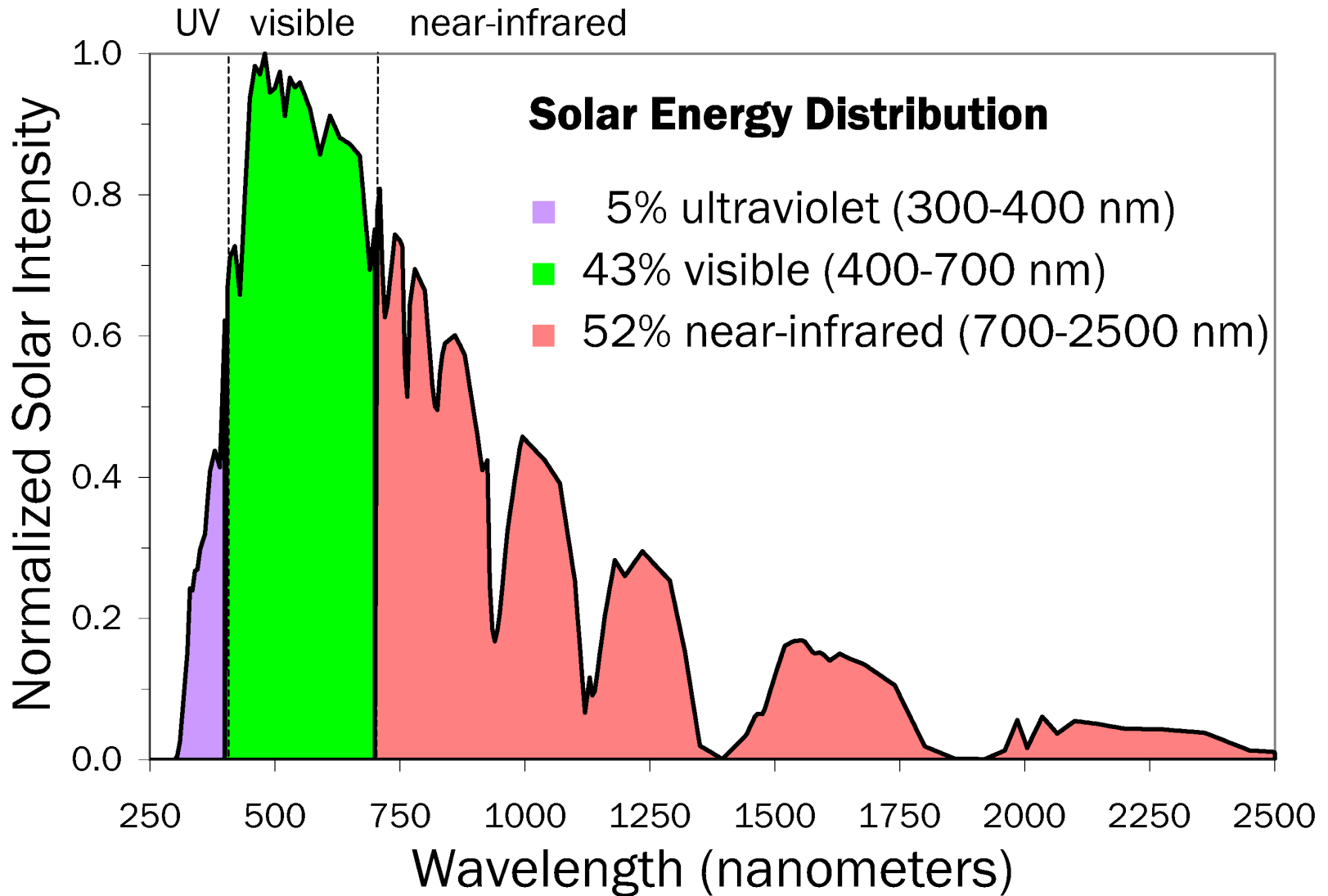


Cool Communities

- ◆ The most lucrative way to:
 - Save air conditioning
 - Cool cities
 - Reduce Urban Ozone
- ◆ Involves 3 strategies:
 - White roofs (5,000 yr old idea) and cool **colored** roofs (a new idea)
 - Cooler pavements (concrete colored to avoid glare)
 - Shade trees (shade buildings and cool by evapo-transpiration)
- ◆ CEC spent \$10 Million for white “re-roofs” and offers credits for cool roofs in meeting new building standards
- ◆ Benefits can be substantial:
 - In LA Basin, 3 strategies can save 1,500 MW and \$ 200 million per year in A/C; Cool LA by 3-4 degrees Celsius; and reduce ozone by 4 – 8 %, worth another \$ 250 million per year in reduced sickness and sick leave

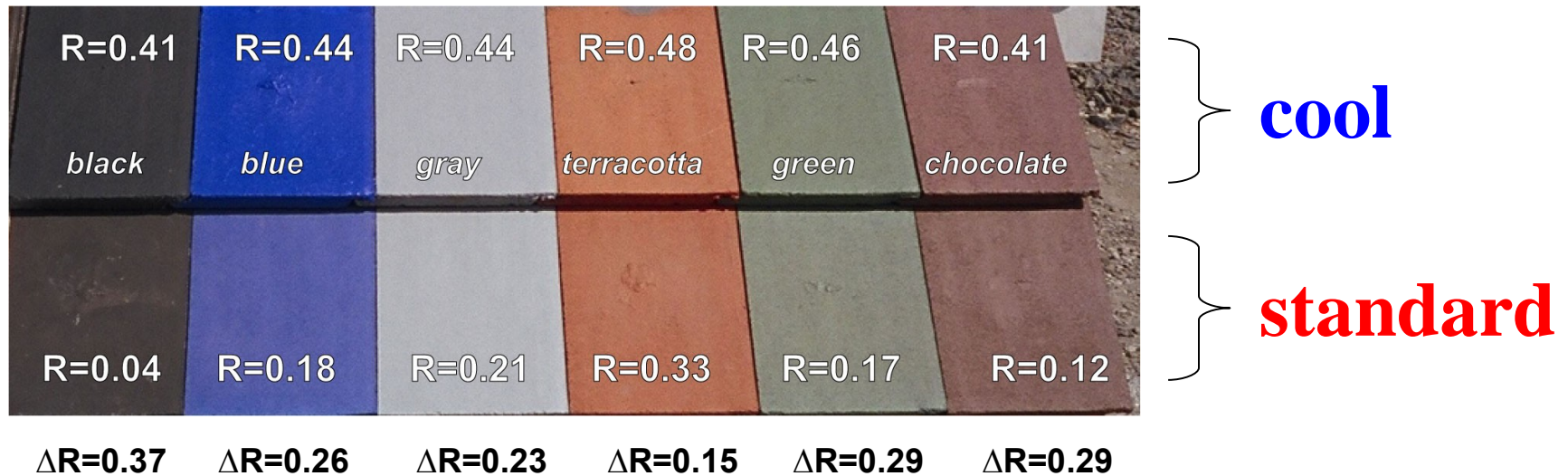
California Cool Roof Policies

- ◆ Annual Public Goods-funded Utility programs of \$2 to \$3 M/year, offer rebates of ~10 cents/sqft.
- ◆ 2005 Building Standards for flat roofs: White is required.
- ◆ 2008 Building Standards for sloped roofs: Cool required (any color).
- ◆ Most buses have white roofs
- ◆ White cars should be bought for public and private fleets
- ◆ R&D
 - Cool Colored Roofs, including cars (recommended in Pavley Report) to reduce emissions by 30%
 - Service Life of Cooler Roofs



Source: Hashem Akbari, LBNL

Cool and Standard Color-Matched Coatings for Concrete Tiles



- ◆ Can increase solar reflectance by 0.3 or more
- ◆ Gain greatest for dark colors

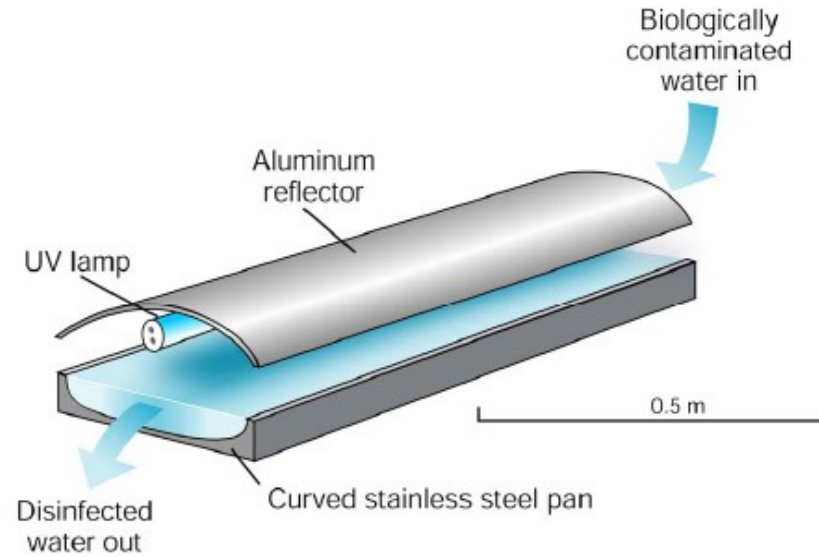
Courtesy: American Rooftile Coatings

Some Products for the Developing World that Save Energy and Carbon Emissions

- ◆ **UV Water Purification avoids boiling water and thus Carbon Dioxide**
- ◆ **LED Flashlights avoid 1.3 million barrels/day of kerosene thus CO₂**
- ◆ **Earthquake-safe, energy efficient, and affordable housing**
- ◆ **The most surprising is cool roofs, which reflect light and heat back into space and cool the world directly. This is the same “albedo” effect which has heated Alaska by 3 F, even though the world is up only 0.7F.**

2-3% of land is now urban. If all major hot cities switched to cool roofs over 20-10 years, we'd delay global warming by about 1 year. That sounds trivial, but it corresponds to offsetting a year of world CO₂ emissions, -- 25 B tons. CO₂ now trades in Europe for \$25/tonne, so the “CDM” value is over \$600 Billion.

UV Water Works



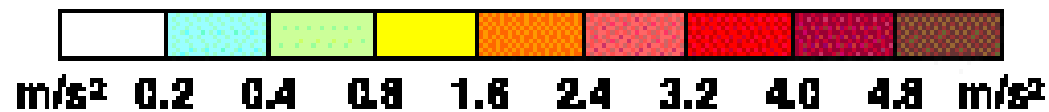
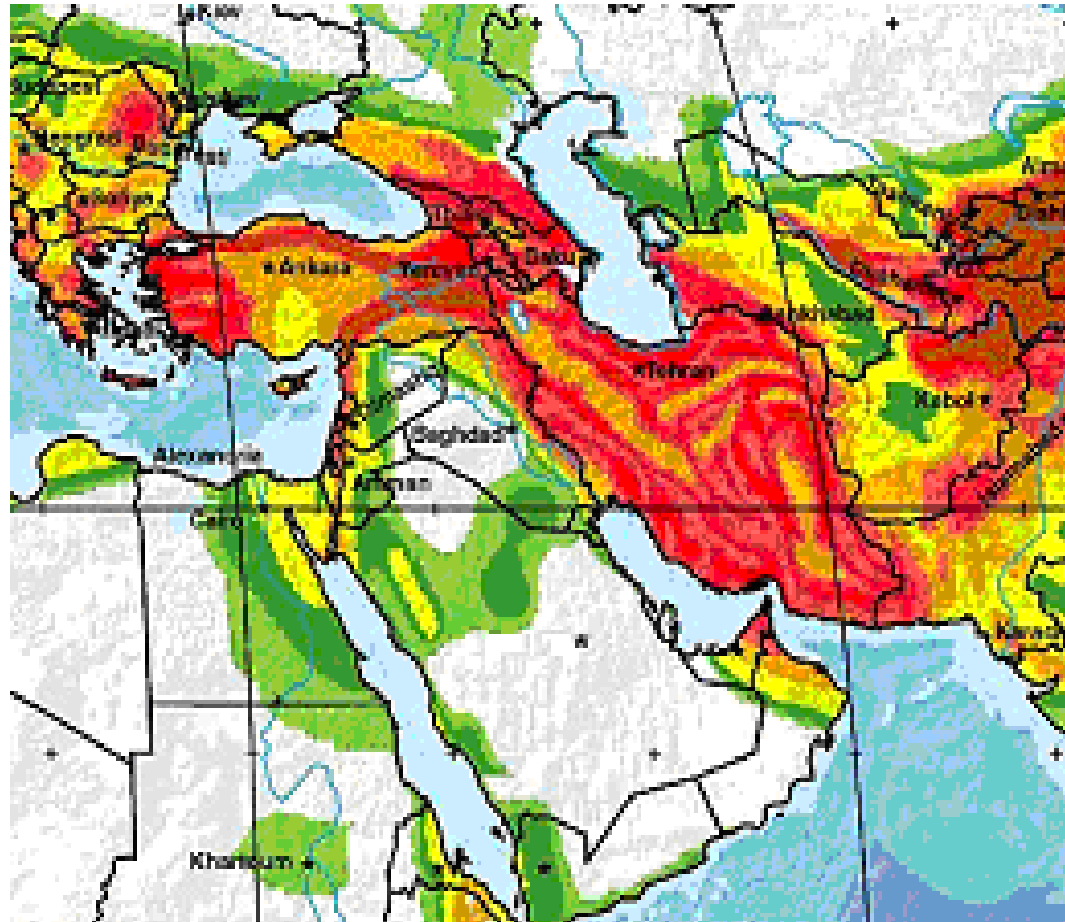
UV Water Works (cont'd)

- ◆ **Key Features:**
- ◆ **15 liter/min. (4 gal./min.), i.e. 1 tonne/hour of purified water.**
- ◆ **Low energy use: 40 watts.**
- ◆ **Low maintenance: germicidal lamp lasts 1-2 years.**
- ◆ **Lamp is not immersed, so need not be frequently cleaned**
- ◆ **Effective with gravity-flow water system**
- ◆ **Float switch regulates water in customer-supplied storage tank**
- ◆ **Cost, \$2000 without sand filters. Complete village installation \$5-10k.**
- ◆ **Capital cost is \$10/person for clean water “forever.”**
- ◆ **In a few Mexican villages, acute diarrhea cases dropped:- 70/month to 7.**
- ◆ **Energy Efficiency. Avoids boiling water over a wood stove, which takes yearly 1,000 tons of wood, producing ~2500 tonnes CO2 equivalent. May be eligible for CDM credits.**
- ◆ **www.WaterHealth.com**

For off grid: an LED Flashlight or Headlight

- ◆ The Ignite Light is designed for those with limited or no access to electricity. **They burn 1.3 Mbod of kerosene !!!**
- ◆ It uses Light Emitting Diode(LED) technology
- ◆ Charges using solar panels during the day with rechargeable nickel cadmium batteries
- ◆ Provides 3 to 4 hours of light at night for general illumination or lighting for reading, housework, etc.
- ◆ For additional information:
- ◆ http://www.gsb.stanford.edu/news/headlines/led_lamps.shstml
- ◆ <http://www.igniteinnovations.com>
- ◆ <http://www.lutw.org/index.html> (Light Up the World)
- ◆ http://eetd.lbl.gov/emills/PUBS/Fuel_Based_Lighting.html Evan Mills
- ◆ I have now learned that there are many more startups: e.g. Columbia Univ. Millenium Village lamp and cell-phone charger uses a 7-W CFL and has a price target of only \$30.

Seismic Zones in Central Asia



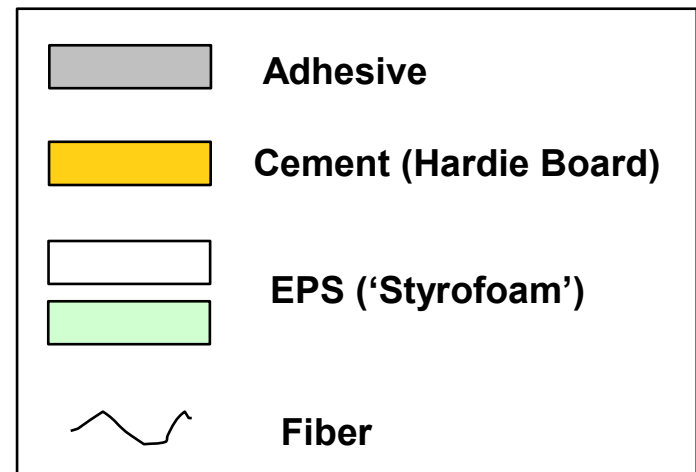
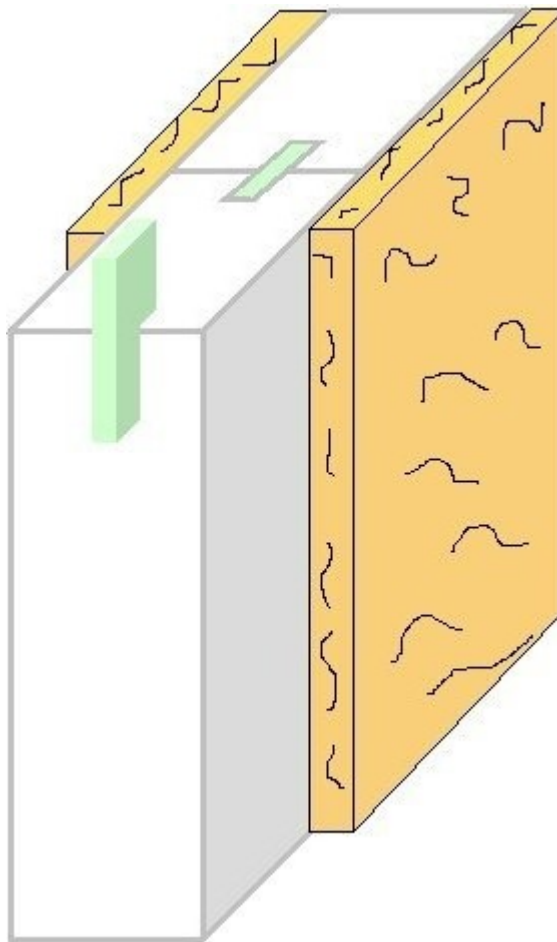
Residence after 1999 earthquake near Istanbul



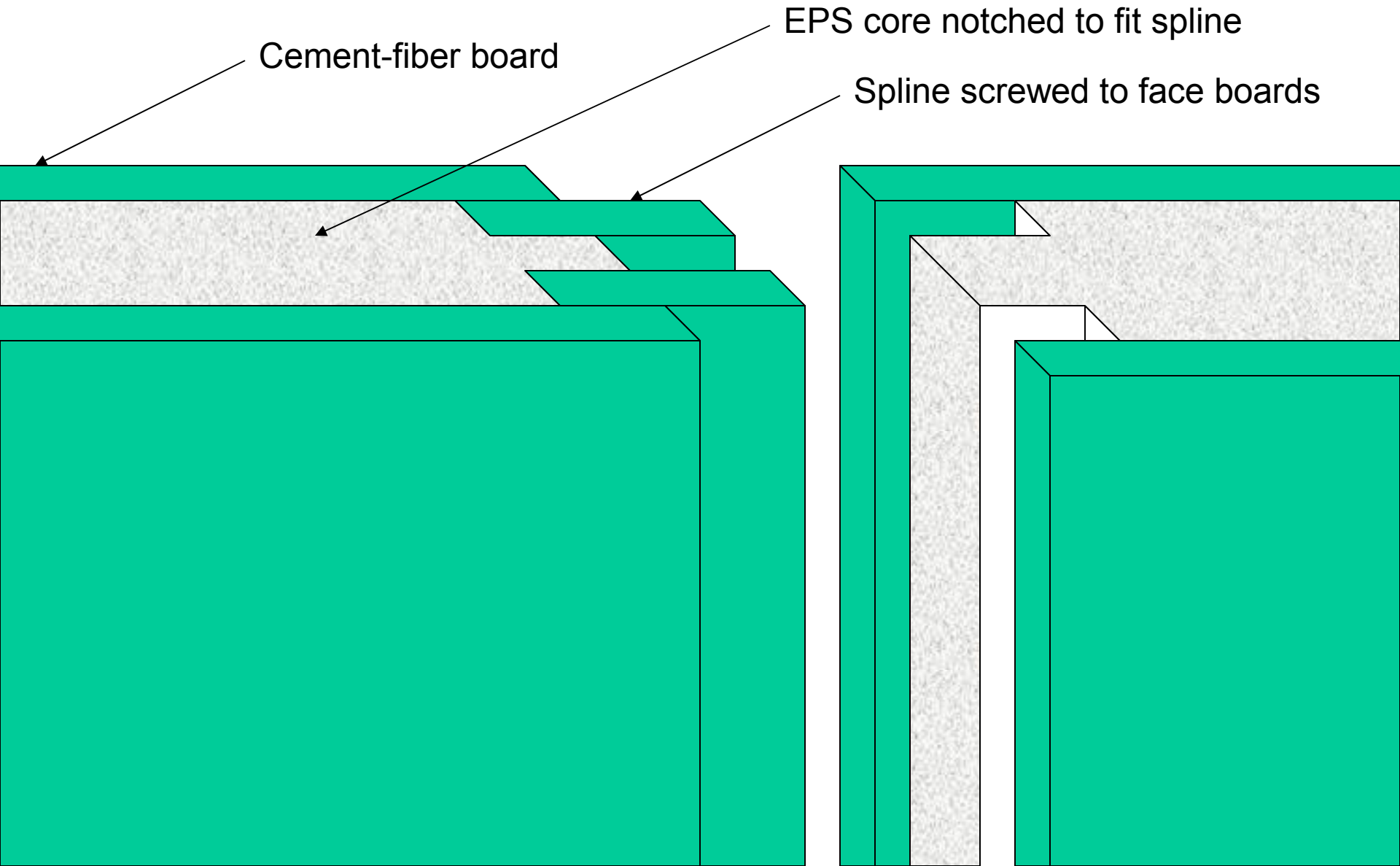
Apartments after Earthquake

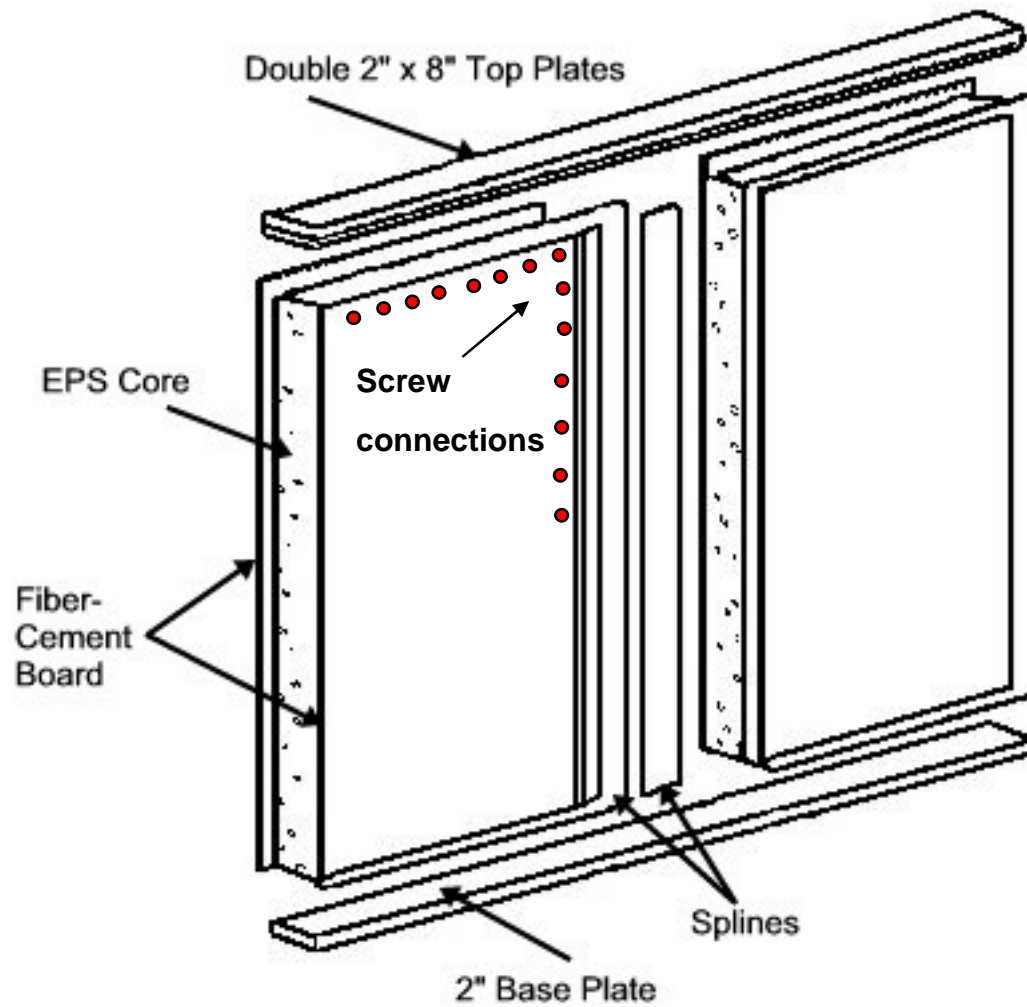


- ❑ Cement Board in 3 thicknesses 7/16" to 3/4"
- ❑ Used for roofing, flooring, interior and exterior walls
- ❑ EPS cores from 3.5" to 11.25"



Panel Connections





Panel Assembly Detail
Diagram 1

Test Structures

Houston, Texas

- 2156 ft²
- Start 10/05

Istanbul area

- 300 m²
- Start 11/05

-
- ◆ Concrete/Styrofoam panels
 - ◆ Energy-usage monitoring
 - o Water heating
 - o HVAC
 - o Lighting



RASBACH PROVIDENT HOME
RDR GROUP, LLC.-Henry Grissom

Truck Supported by Panels

(6" expanded polystyrene clad with plywood. Pickup supported by 2 panels each 4' x 24')

